The Early Eocene in high-def: a new global digital elevation model

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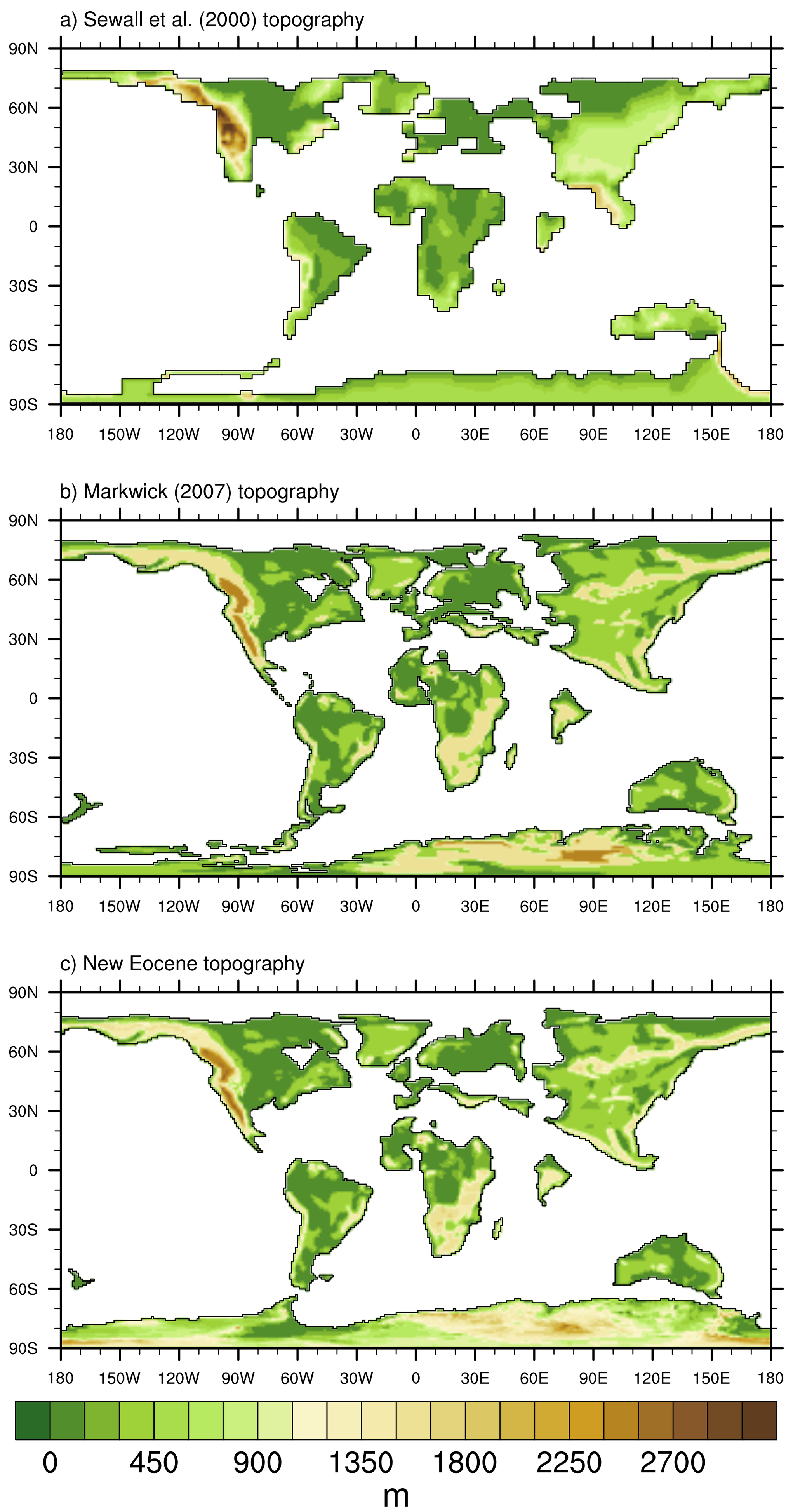
Abstract: We make available a set of Early Eocene (~55 Ma) topographic and bathymetric climate model boundary conditions. These represent a significant improvement over previous boundary conditions and are made available at 1°x1° to facilitate high resolution global and regional climate modelling. Given the uncertainties involved in reconstructing such datasets, they should be viewed as one interpretation of the available data and users are encouraged to modify these based on their own data and interpretations.

Figure 1: The most recent, publicly available Eocene topography was developed by Sewall et al. (2000) over a decade ago (panel a). We use the Eocene topography of Markwick (2007) (panel b) as the basis for our new topographic boundary condition. We make several adjustments to this, including changes in Eurasian, African and Australian paleoshorelines, and implementation of the ANTscape Antarctic topography (Wilson et al., 2012) (panels b vs c).



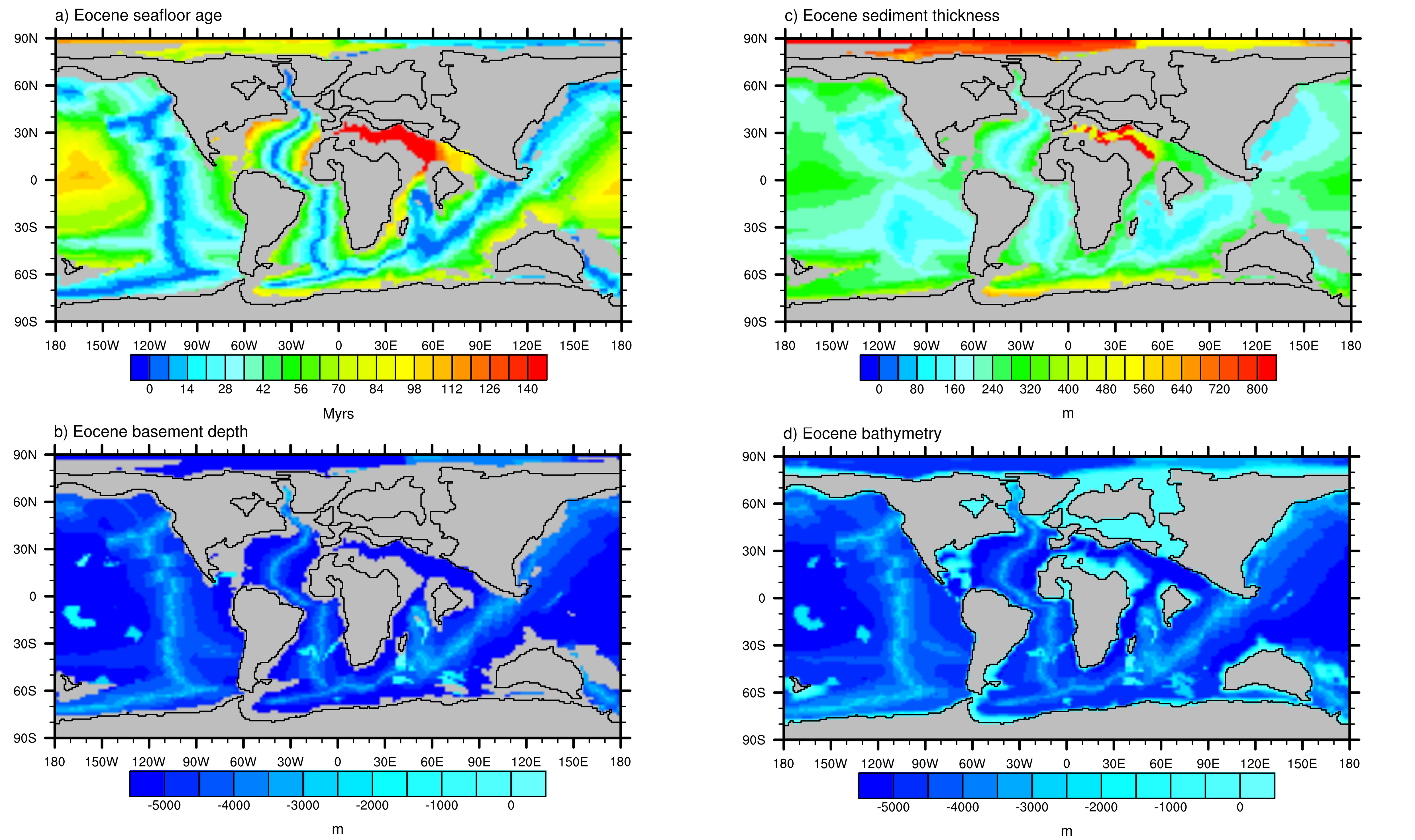


Figure 2: Our Eocene bathymetry was built by first reconstructing 55 Ma isochron data (panel a) and applying an age-depth relationship to determine basement depth (panel b). Eocene sediment thickness is then estimated based on the modern relation to latitude and age (panel c), and added to basement depth. Lastly, large igneous provinces are reconstructed to produce our final Eocene bathymetry (panel d). Regions with no bathymetric data are interpolated using a Poisson equation solver. More details are in Müller et al. (2008).

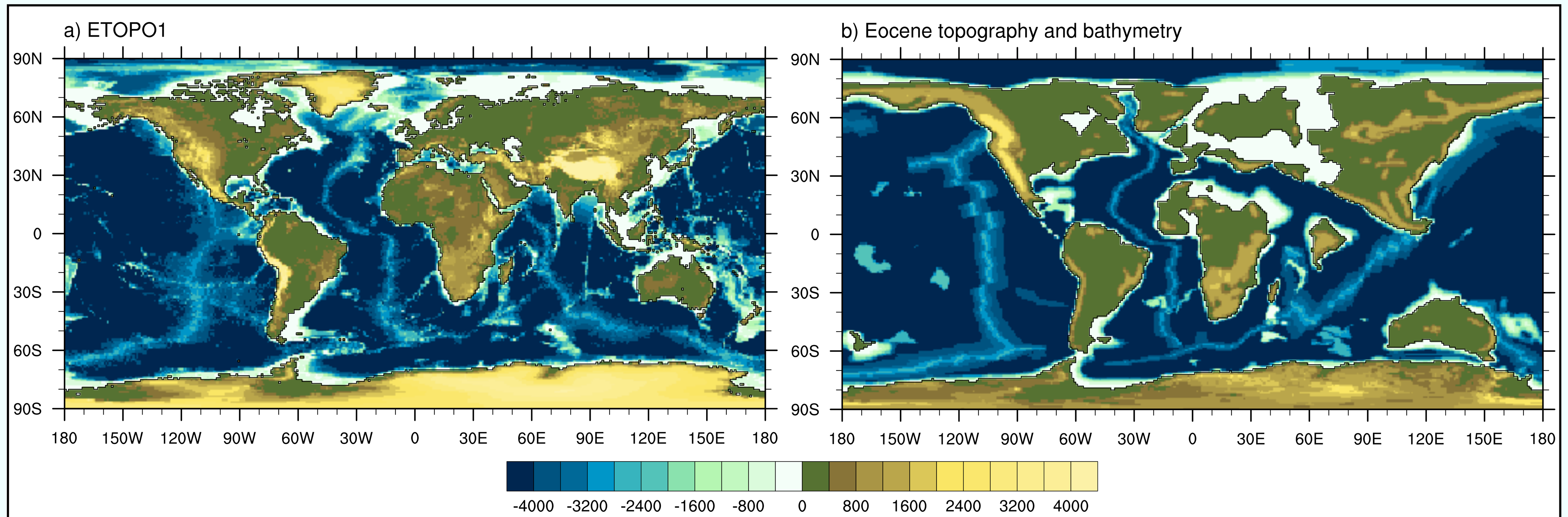
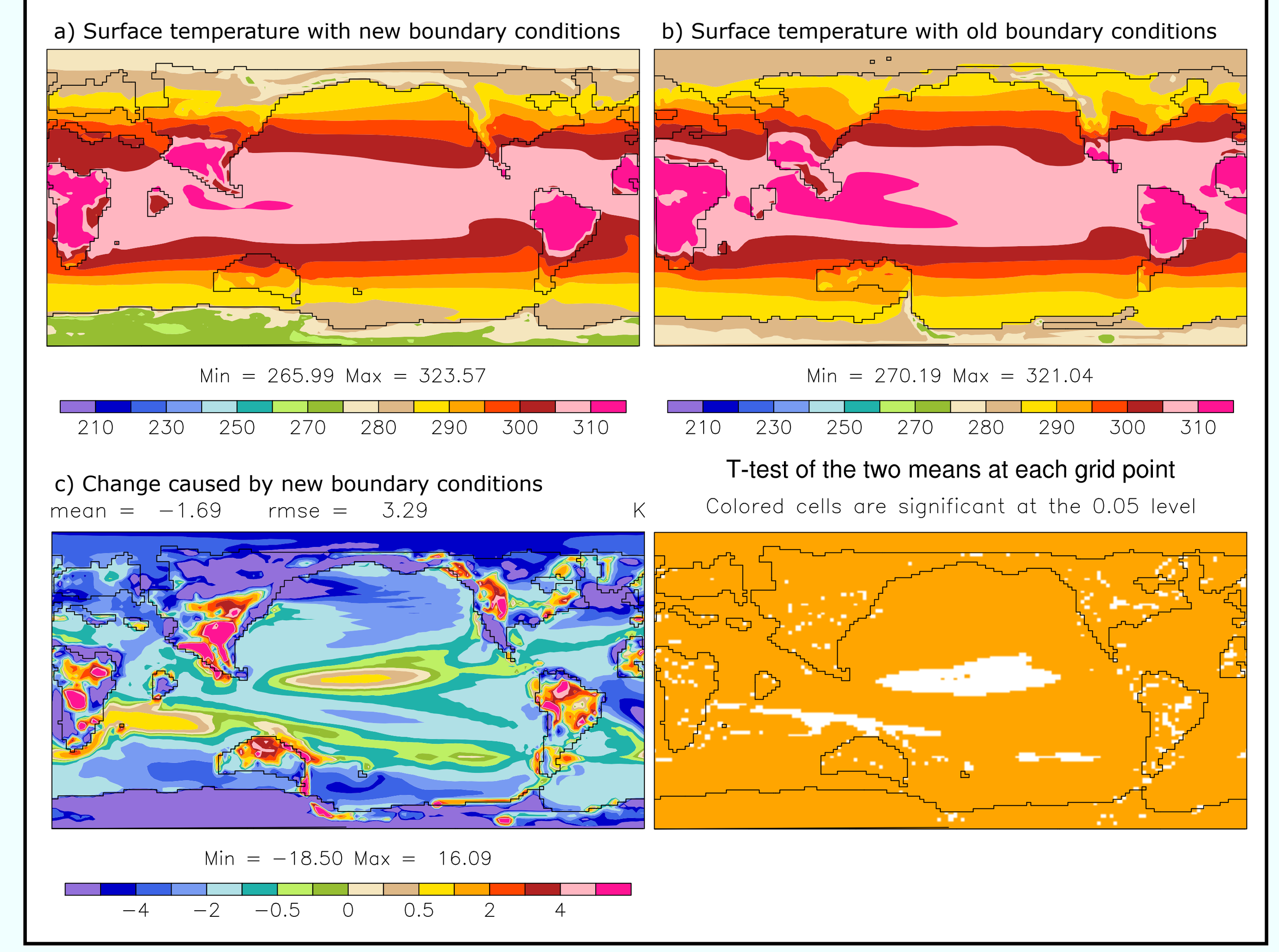


Figure 3: Modern day (ETOPO1) topography and bathymetry (panel a) and our newly merged Eocene topography and bathymetry (panel b). The base dataset used for our Eocene topography (Markwick, 2007) was re-rotated to be consistent with the reference frame of our Eocene bathymetry (Müller et al., 2008).

Figure 4: Preliminary results show the primary effect of the new Eocene topography and bathymetry, compared to previous boundary conditions (Sewall et al., 2000), is to cool the high latitudes (panel c). This is primarily due to changes in elevation and land mask in Antarctica and Eurasia in our new topography (Figure 1). Simulations conducted with the Community Earth System Model.



Summary

We present new Eocene topography and bathymetry with the intention of improving uniformity of experiment design between research groups modelling Eocene climates. Given the uncertainties involved in constructing boundary conditions for past time periods users are encouraged to view this dataset as one interpretation of the available data and are encouraged to modify this according to their own data and interpretations.

References/funding/affiliations

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